CHP Projects:
Analytic Tools for Removing Institutional and Regulatory Barriers and Developing CHP Markets

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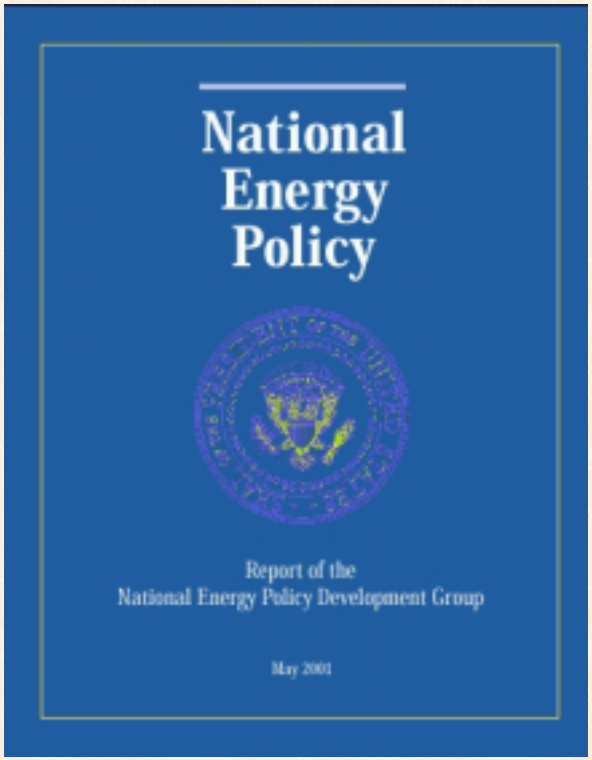
Distributed Energy Peer Review

December 3, 2003

National Energy Policy



"This plant boils enough water to heat 146 major office buildings in downtown St. Paul. Not a bit of energy is wasted, not even the waste."

President Bush, May 17, 2001, St. Paul, Minnesota

- ***Of the 105 total recommendations…***
  - ***21 affect distributed energy***

CHP Vision and Technology Roadmap

Challenge Goal: By 2010, double the amount of CHP in the U.S.

1998, 46GW → 2010, 92GW

Consensus Action Items from CHP Roadmap:

- Raise CHP Awareness
- Eliminate Regulatory and Institutional Barriers
- Develop CHP Markets and Technologies

Major findings of the CHP Vision and Roadmap

- CHP is a win-win-win solution
- The potential for expanding the use of CHP in the U.S. is enormous
- The CHP challenge goal is doable
- An industry-government partnership is the best framework to use for achieving the CHP Challenge goal
- Implementation involves a high degree of coordination, partnerships, and leveraging of resources among a wide variety of organizations across the country

Project Description and Goals/Objectives

- ORNL issued a solicitation in August 2002 for actions to address objectives of:
  - Raising CHP awareness
  - Eliminating regulatory and institutional barriers
  - Developing markets and technologies
- Awards made February 2003; multi-year plan
- Work towards meeting the "CHP Challenge" of achieving 92 GW by year 2010
  - Baseline CHP installations
  - Assess technical and economic potential
  - Address market issues and barriers

Project Team

- American Council for an Energy Efficient Economy
- American Gas Foundation
- Cool Solutions
- Distributed Utility Associates
- Energetics
- Energy and Environmental Analysis
- Energy International
- Gas Technology Institute
- IC Thomasson
- International District Energy Association
- Northeast-Midwest Institute
- Resource Dynamics
- University of Illinois at Chicago
- United States Combined Heat and Power Association

Partnerships Formed to Overcome Barriers

- EPA
- HUD Energy Division
- DOE FEMP, OIT, OBT
- EPRI
- NYSERDA
- CEC
- ASERTTI
- US Green Buildings Council
- Energy Solutions Center
- States through CHP Regional Initiatives and DOE Regional Offices

Task definition and activities

Task 1: Raising CHP Awareness

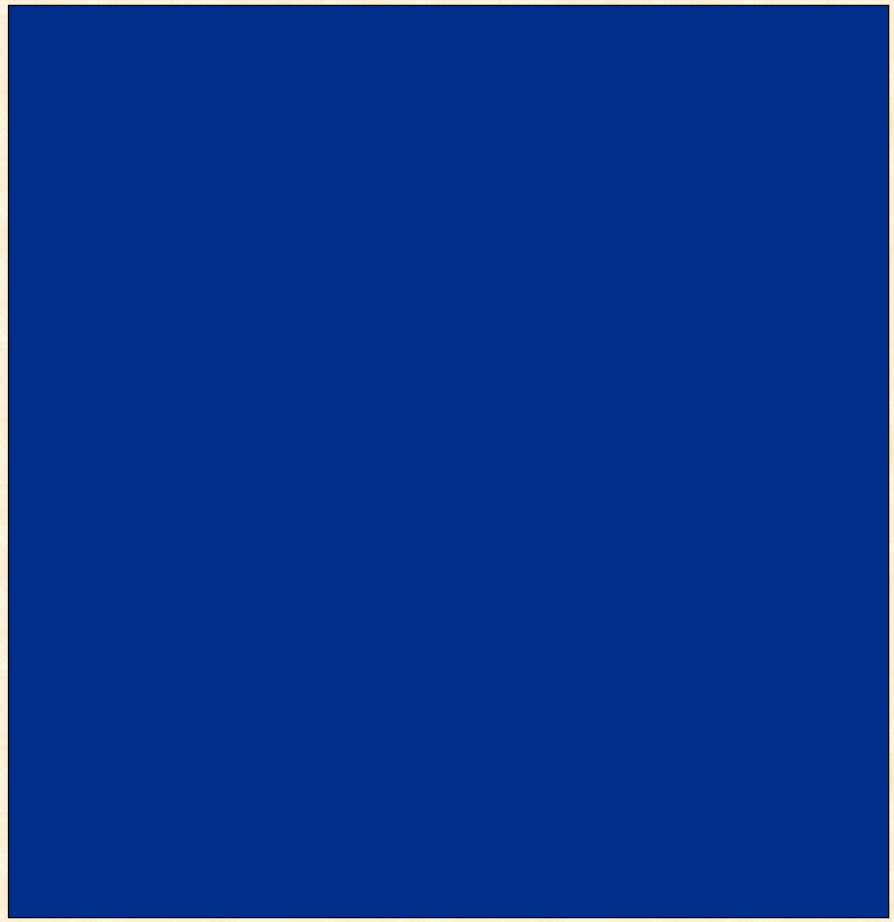
- Regional Initiatives
- CHP Application Centers
- CHP Roadmap Meeting
- Participated in trade shows, meetings and educational activities for targeted audiences (ex.):
  - AGA's National Accounts Meeting (Chicago)
  - Association of Energy Engineers (Atlanta)
  - Energy EXPO (Worcester)
  - ASHE (San Antonio)
  - CHP Policy Day (Washington, DC)
  - International CHP Conference for WADE (Rio)
  - FEMP DER/CHP Training Workshops

Task 2: Eliminating Regulatory and Institutional Barriers

- Air regulations, environmental permitting
  - Research on emissions permitting
  - Environmental permitting screening tool
  - Review of environmental models
- Interconnection requirements
  - Utility interconnection practices
- Site permitting, tax treatment
  - Analyze cost and financing of DG/CHP
  - Review of DG siting procedures
- Costly standby and backup power charges
  - Electric rate primer
  - Review of States' CHP activities

Task 3: Developing Markets

- Baseline CHP installations
- Assess technical and economic potential
- Identify the value proposition



Milestones Completed in FY03

- Project Team coordination review meeting (April 2003)
- 4th Annual CHP Roadmap Meeting (September 2003)
- 1st Annual Coordination Meeting with newly awarded CHP Application Centers (September 2003)
- Monthly CHP Team Meetings
- Monthly teleconferences of CHP Regional Initiatives
- Completed Survey of DER/CHP Software
- Completed analysis of technical data and market studies to develop prioritized focused initiatives
- Issued numerous publications and fact sheets

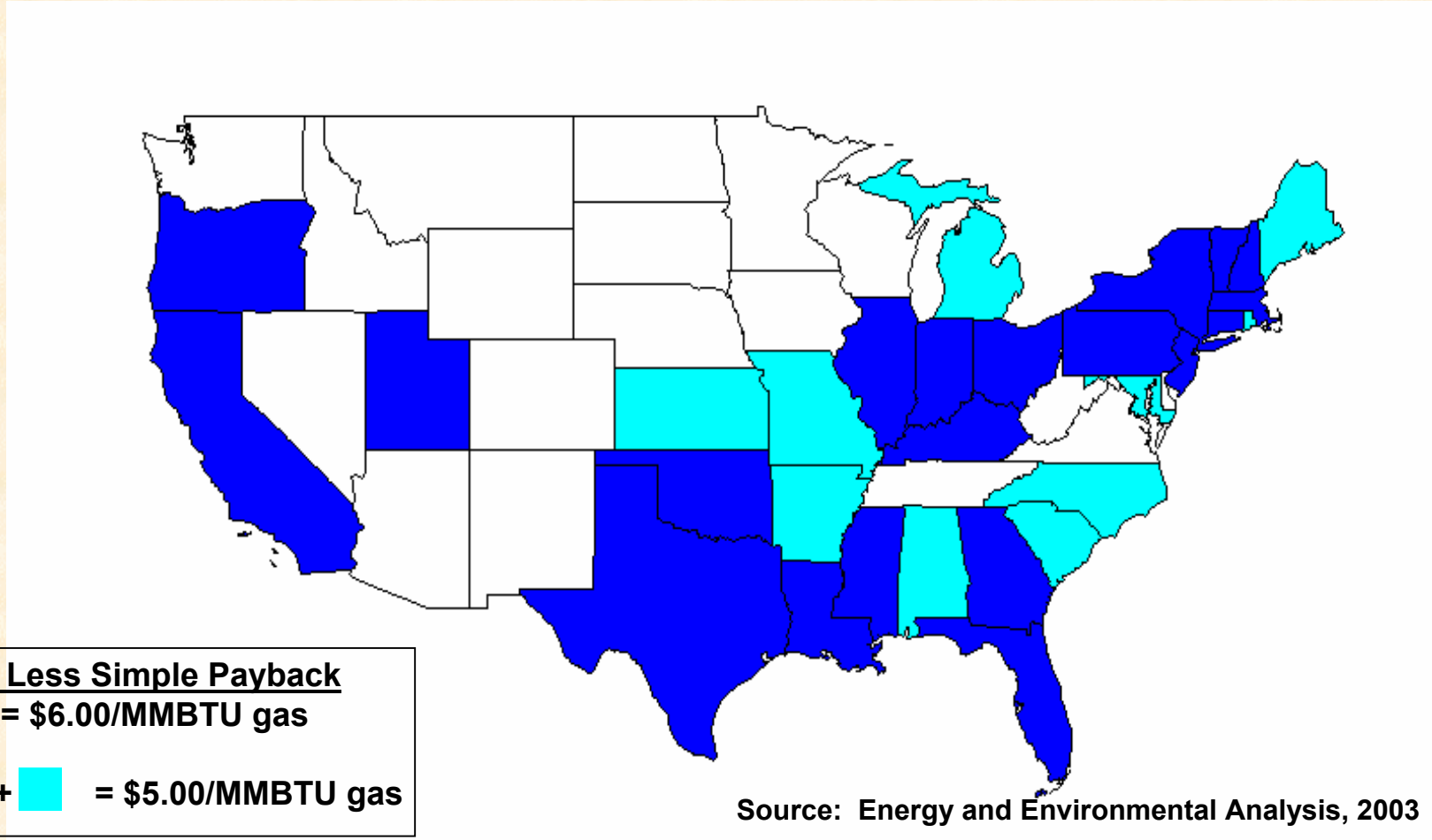
Our Progress to Date — November 2003

DG/CHP Operational Reliability Database Provides Real-Life Answers to "How Do They Work?"

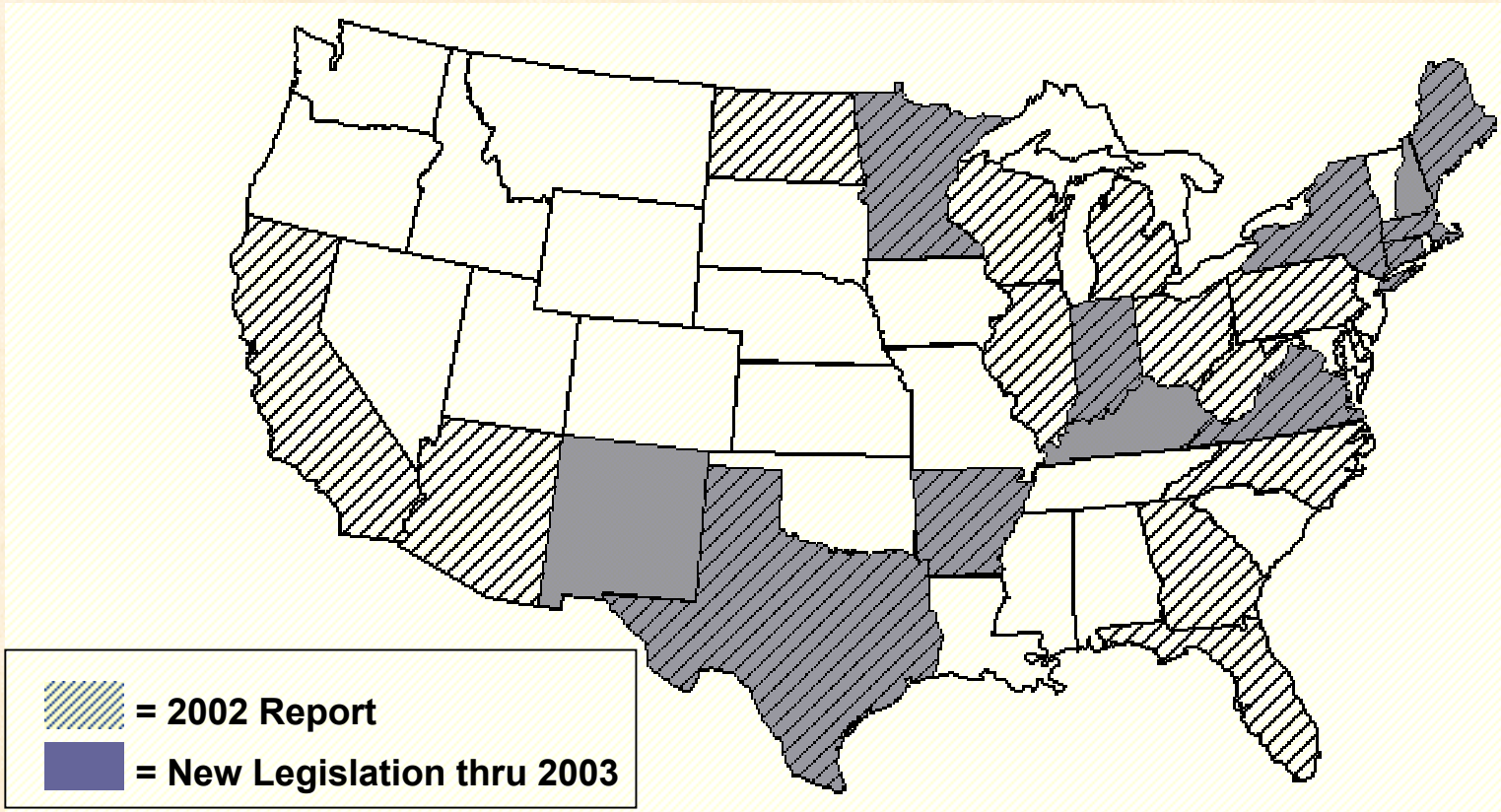
	Gas Turbine			Reciprocating Engine			Steam Turbine		
	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.
Availability Factor %	95.15	99.45	90.40	96.73	100.00	84.55	94.57	99.18	88.36
Forced Outage Factor %	2.58	6.63	0.00	0.57	2.33	0.00	1.26	6.22	0.01
Scheduled Outage Factor %	2.62	7.61	0.27	3.28	14.22	0.00	4.68	7.12	2.57
Service Factor %	86.64	99.45	1.52	38.29	99.18	1.50	92.23	97.03	76.07
Mean Time Between Forced Outages	2371	17424	266	3865	20305	263	9888	29585	2913
Mean Down Time	34.25	120.00	2.00	109.20	249.62	2.00	64.91	96.74	41.70

Source: Energy and Environmental Analysis, 2003

Results of Large (2-50MW) CHP Market Analysis Identifies Opportunities of use to CHP Application Centers



Survey of State Policies Reveal States with CHP Legislation and Regulation

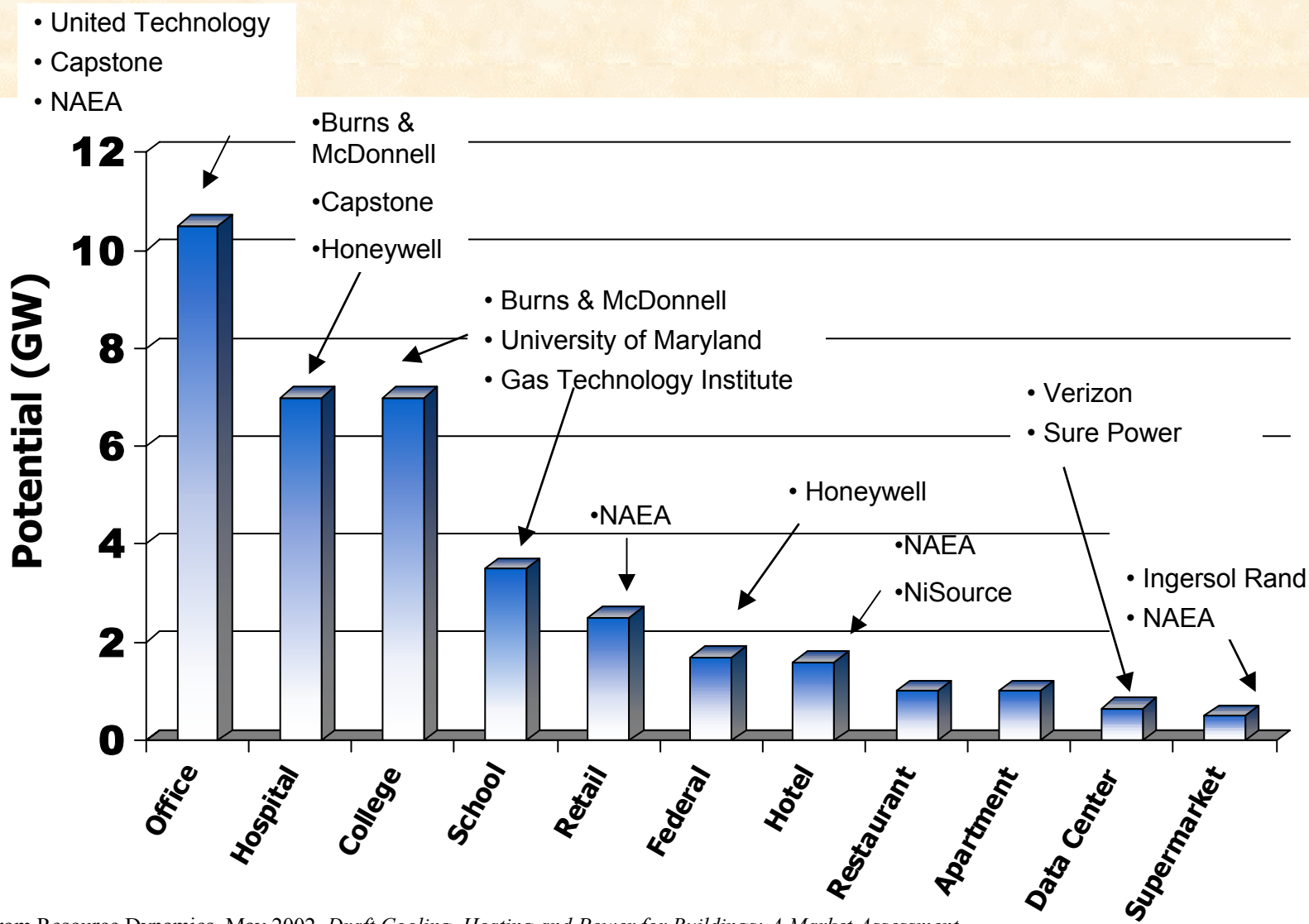


Source: American Council for an Energy Efficient Economy

Publicly Available DER/CHP Software was Evaluated by ORNL

- Software packages categorized by:
  - intended use
  - types of calculations
  - analysis duration
  - DER/CHP technologies
  - data libraries
  - types of CHP processes
  - cost and availability
- Results available via presentations and available on DOE website

Commercial sector has high DE/CHP potential



Data from Resource Dynamics, May 2002, *Draft Cooling, Heating and Power for Buildings: A Market Assessment*

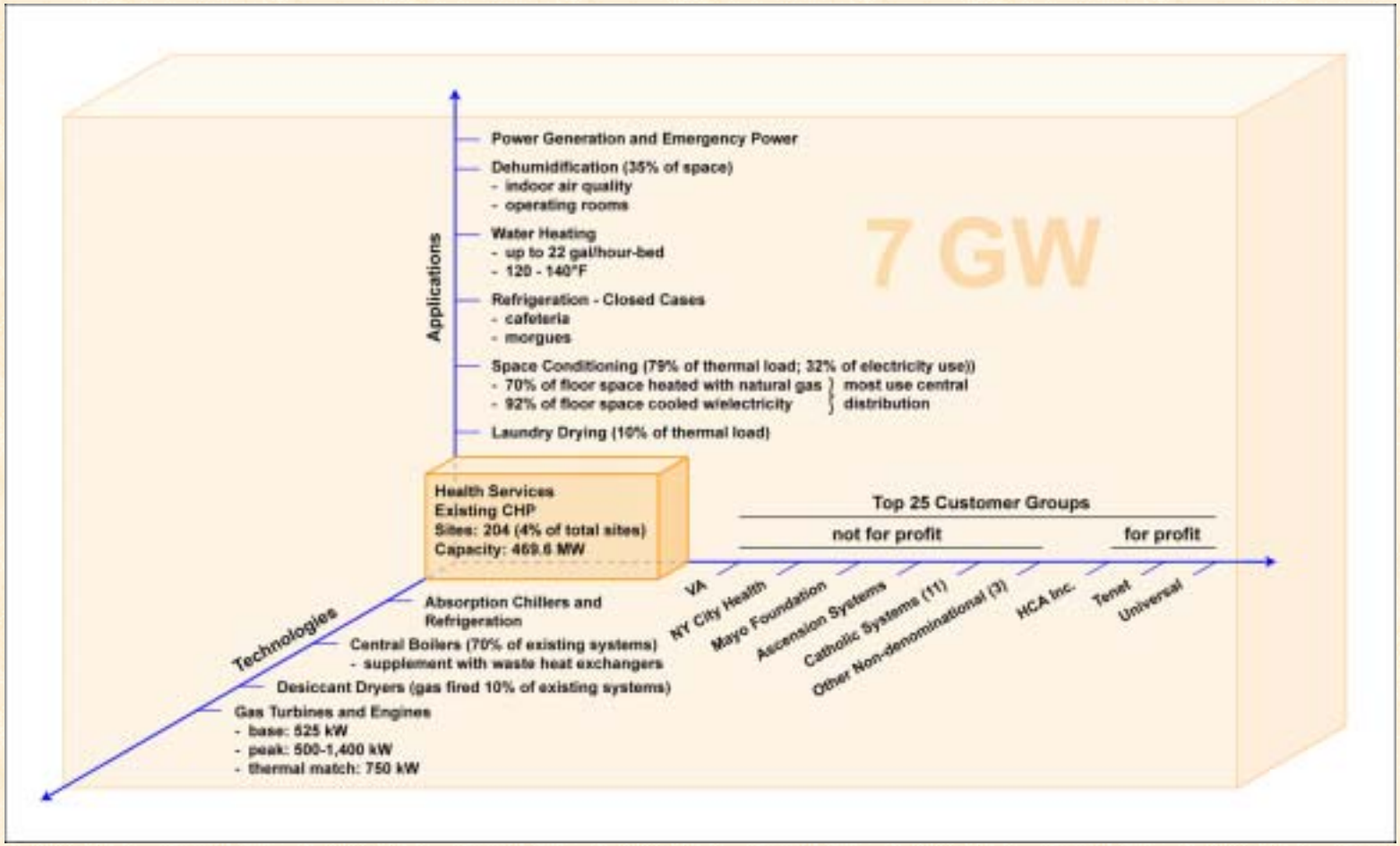
UIC Explored Major Issues Affecting 3 Market Segments

1. Smaller Educational Facilities
   - K-12 Buildings >400 kW in Demand – Mainly High Schools
     - 7,400 Sites = 11.9 GW Potential
     - Key: Emergency Power, Public Disaster Shelters
2. Smaller Healthcare Facilities
   - Nursing Care Facilities (Non-Ambulatory Patients)
     - 15,600 Sites = 5.2 GW Potential
     - Key: Reliable Power/Cooling Patients
   - Laboratory Facilities
     - 10,500 Sites
     - Key: Power-Disasters (Blood Refrig. & Pathogen Containment)
3. Data Centers/Server Farms/Telecom Switching Centers
   - Data and Internet Facilities Employing UPS Systems >100 kW
     - 14,000 Sites = 2.6 GW Potential
     - Key: Reliable Power/Cooling – Constant. Volt. & Freq
   - Telephone "Central Offices"
     - 20,000 Sites = 5 GW Potential
     - Key: DC Power, Reliability, Consist Voltage

CHP on Campus – A Growing Market

- **Phase I –** ***Determine current size of market***
  - 160+ campus systems Posted on Website: 967 MW electricity; 932,400 Tons cooling; 4,200,000 Lbs/hr steam
- **Phase II –** ***Understand market drivers***
  - Posted 9 CHP Campus Case studies on Website
  - "How to Build CHP on Campus Workshop" & Guidebook; 240+ attend Campus Energy Conference
- **Phase III –** ***Support market participants***
  - **Screened 71 CHP prospects to 24 top priority projects = 445+ MW CHP growth "near term"**
  - **"Project Analyzer" screening tool to evaluate projects on 20 specific metrics**
  - **Listed and correlated common factors and hurdles across regions**
  - **Strong Campus CHP market**

Example Market Analysis: 7GW of CHP potential, CHP technology matches needs



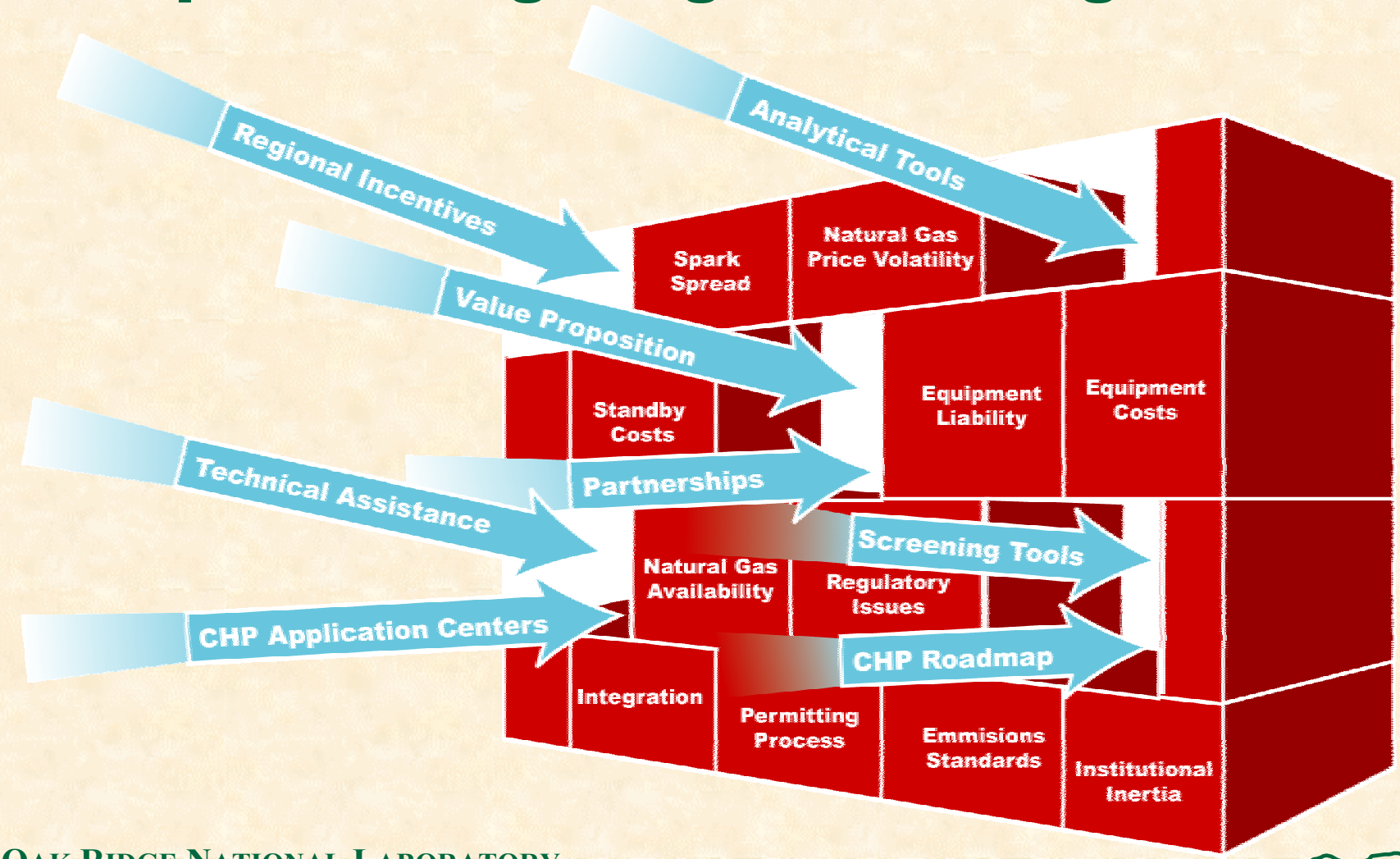
Example Success: Hospital CHP Market Development

- Market Development Plan
  - Charts strategy to accelerate CHP commercialization in hospitals
- Accomplishments
  - Market research interviews and surveys
  - ASHE conference events
  - Website postings: www.eere.energy.gov/chp/hospitals
    - CHP Primer including packaged systems
  - Pilot implementation in Midwest Region
- Path forward—business and technical communications directed to decision makers

Milestones Planned for FY2004

- Monthly CHP team meetings with EPA, HUD, USCHPA, IDEA, ACEEE, NEMW, manufacturers, end-users, other stakeholders
- Teleconferences with CHP Regional Initiatives
- Continue coordination of CHP Application Centers
- Provide technical assistance to CHP Application Centers
- Hold *5th Annual CHP Roadmap Meeting* to evaluate progress and update yearly operating plan
- Complete technical analysis, tools, spreadsheets, guides, reports and other technical materials as described in project summary

Barriers and Risks can be Mitigated by Implementing Program Strategies



Successful Completion of CHP Activities Supports DE Program Goals:

- Expand choice
- Clean, efficient, affordable on-site power generation
- R&D Partnerships
- Technology integration
- Flexible, smarter energy system

Summary

- Successfully formed CHP ad-hoc team to leverage public/private funds:
  - equipment manufacturers
  - electric and gas utilities
  - end-users
  - architect and engineering firms
  - project developers
  - federal and state agencies
  - universities
  - national laboratories
- Progress has been made addressing *CHP Roadmap* tasks
- Technical results and reports have been made available to the public
- Technical support and coordination of the Regional Application Centers and Initiatives is growing


Thank You!
2010
92 GW
WE ARE HERE
2003
77 GW
1998
46 GW
DETOUR
CTC
RIGHT TURN ONLY
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